



# Electronic Brachytherapy and Superficial Radiation Therapy: Will You Be Adding It to Your Practice?

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**H**ow often do you consider radiation therapy as a treatment option for nonmelanoma skin cancers (NMSCs)? Malignancies, including skin cancers, have been treated with radiation since the early 1900s,<sup>1</sup> but this treatment method fell out of favor because of improved cure rates achieved via surgical excision and Mohs micrographic surgery as well as the high cost of radiation devices.<sup>2</sup> First-line treatment of NMSCs includes modalities such as electrodesiccation and curettage; surgery (eg, conventional excision, Mohs surgery); or topical agents when appropriate, such as imiquimod cream 5% (an immunomodulator) or 5-fluorouracil cream (a chemotherapy agent).

Conventional surgical excision and Mohs surgery remain the gold standards for the treatment of NMSC; however, advocates of radiation therapy believe it should be considered more frequently. For some patients, radiation therapy may prove to be the next best treatment option if surgery is not possible. Potential candidates for radiation therapy include patients who cannot tolerate long surgeries or long treatment regimens with topical creams, such as elderly patients, patients taking anticoagulants, and patients with low Eastern Cooperative Oncology Group (ECOG) scores. Of note, ECOG scores were developed by oncologists to assess how a patient's oncologic disease is progressing but also can be used

to gauge general health status (grade 0: a patient is fully active and able to carry on all predisease performance without restriction; grade 1: restricted in physically strenuous activity but ambulatory and able to carry out work of a light sedentary nature [eg, housework]; grade 2: ambulatory and capable of all self-care but unable to carry out any work activities [up and about >50% of waking hours]; grade 3: capable of only limited self-care, confined to bed or chair >50% of waking hours; grade 4: completely disabled, cannot carry out any self-care, totally confined to bed or chair; grade 5: dead).<sup>3</sup> Radiation therapy also may be considered for malignancies located on areas of the body where surgery can result in complicated or tight closures with less than optimal cosmetic outcomes such as on the head, neck, dorsal aspect of the hands, or lower extremities.<sup>4</sup> The use of radiation therapy in areas with poor vascularity and slow healing rates, such as the anterior aspect of the limbs, has prompted conflicting opinions.<sup>2,5</sup> Radiation therapy also may be an option for patients who would prefer to avoid the process of surgery and subsequent surgical scars but do not fulfill any of the exclusion criteria.

There are multiple ways to deliver radiation to a tumor. External beam radiation therapy uses a linear accelerator to generate radiation in the megavolt energy range. Traditional brachytherapy involves placement of the radiation source, usually a radioactive isotope, into the patient within a body cavity or directly into tissue. More recently, electronic brachytherapy (EBT) and superficial radiation therapy (SRT) devices have become more commercially available and are being actively marketed to

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dermatologists, including the Axxent eBx System (Xoft, Inc), Intrabeam System (Carl Zeiss Meditec), and SRT-100 (Sensus Healthcare).

Electronic brachytherapy and SRT differ from traditional brachytherapy and radiation therapy in a few ways. Both EBT and SRT transmit radiation by placing a probe near or onto the skin, not inside the body; thus it is a form of external beam radiation. Second, these technologies do not use a radioactive isotope as the energy source; instead radiation energy is electronically generated. Third, the energy used in EBT and SRT is in the kilovolt range and therefore has been deemed low energy, unlike the high energy (in the megavolt range) emitted by external beam radiation therapy. The eBx System and Intrabeam System deliver a maximum energy of 50 kV<sup>6,7</sup> and SRT-100 a maximum energy of 120 kV.<sup>8</sup> The low-energy nature of these devices makes them easier to use in outpatient practices than other radiation therapy equipment. One exciting feature is that procedure rooms do not need to be shielded as they are with high-energy radiation tools.

What is shielding and why is it important? In the simplest terms, high-energy radiation (eg, the megavolt range) can penetrate deep into the body through clothing, skin, and bones. During treatment, the primary beam is directed toward the patient; however, all individuals in the room are exposed to leakage radiation (radiation that passes through the patient) and scatter radiation (radiation that scatters from the patient as well as the ceiling, floors, and walls) in addition to the primary beam. A properly shielded treatment room must meet strict regulatory guidelines, and specialized personnel must plan its structure (if the walls, floors, and ceilings will be made of fortified cement, lead, or brick) and give special consideration to the location of the room (eg, on the ground floor in the corner of the building or on the second floor with rooms above, below, and on either side of the procedure room).<sup>9</sup> Low-energy radiation does not have the same penetration abilities, providing practitioners with more practical options because clinics do not require the same amount of planning or investment into infrastructure to develop a properly shielded room. Additionally, some of the devices are portable, and staff members can be in the room with the patient during the treatment.<sup>7</sup>

Another benefit of EBT and SRT is that the radiation is delivered at a high-dose rate (HDR). Typically, a total dose of radiation will be prescribed for treatment of a single tumor (eg, 40 Gy). This dose is then fractionated and delivered over a series of multiple visits. The total dose can be divided into small-dose prescriptions, requiring more treatment sessions, or administered at an HDR, resulting in fewer treatment

sessions. Compared to other forms of radiation therapy, the delivery of radiation at an HDR translates to a shorter, more convenient treatment period.

Studies on EBT and SRT are limited and it is important to consider that many are led by investigators who are affiliated with the manufacturers of the radiation devices. In a retrospective study, 37 patients with 44 cutaneous malignancies were treated from July 2009 to March 2010 using the eBx System with a dose of 40 Gy delivered in 8 fractions (5 Gy per fraction) twice weekly, with a median follow-up of 4.1 months (range, 1–9 months) in July 2010. The investigators demonstrated good to excellent cosmesis at each follow-up; erythema and dermatitis were the main adverse events.<sup>10</sup> Another study of HDR EBT administered from July 2009 to April 2012 reported no recurrences at 1-year follow-up and acceptable cosmesis. Adverse events included hypopigmentation, desquamation, alopecia, and dermatitis.<sup>11</sup> Despite purported excellent cosmetic results and minimal adverse events, data on long-term sequelae are sparse. One retrospective study by Barysch et al<sup>12</sup> over a 44-year period showed that of 180 squamous cell carcinomas (mean tumor size, 3.5 cm<sup>2</sup>) treated with SRT with a mean follow-up of 4.9 years, the relapse-free survival rate was 95.8% after 1 year and 80.4% after 10 years. Poorly differentiated tumors were associated with higher relapse rates. Relapse-free survival was highest around the eyes and cheeks.<sup>12</sup>

The best practitioners are aware of all available treatment options for a particular diagnosis. Electronic brachytherapy and SRT are rising players in the treatment of NMSCs. Even if you do not use one of these modalities, you should at least be aware of their existence. Short-term results seem favorable for cure rates, cosmesis, and ease of use; however, data on long-term efficacy are minimal to absent. Although it is always exciting and important to have new treatment options, it is imperative to have a firm understanding of the pros and cons of these devices and to have a candid discussion regarding the risks, in particular the paucity of long-term data, and benefits during the process of informed consent.

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